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TECHNICAL PROGRESS REPORT

C12 DETONATOR MALFUNCTIONS IN
EX 1 MOD 0 ILLUMINATING
HAND GRENADE

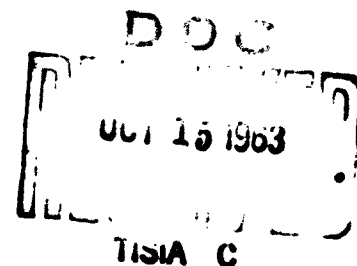
By

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ABSTRACT

The C12 detonator, lot OM-1-23, caused malfunction of the M25A2 grenade in three widely separated instances. At Cherry Point, North Carolina, and at Twentynine Palms, California, failures occurred with the CSI load. At China Lake, California, failures occurred with six-month surveillance samples loaded with TIARA, formula 5.

No leakage of the TIARA 5 load into the detonator cavity was detected in any surveillance samples.

Pine Bluff Arsenal, Pine Bluff, Arkansas, advised that malfunction was caused by defective Mk 39 A1 primers, and that these are being replaced by the EX 2926A Western Cartridge design primers in a new procurement.

Accelerated surveillance of the EX 1 Mod 0 Illuminating Grenade will be started on receipt of the new primer.

INTRODUCTION

In April 1962 the Naval Ordnance Test Station received 1000 plastic hand grenade bodies, M25A2. These were loaded with TIARA formula 5 and assembled with the C12 detonator which is standard for use with this grenade body. Both bodies and detonators were supplied by Army Ordnance. The product was designated Grenade, Hand, Illuminating, EX 1 Mod 0, and released for overseas shipment on 3 May 1962.

On 18 May 1962 100 grenades were shipped to the Republic of Vietnam. A report was made (Ref. 1) that the fuzes behaved in an erratic manner. The minimum delay was 1.5 seconds and the maximum about 3.5 seconds. No mention of duds is made in this test report. Twenty of the grenades were returned to NOTS and placed in surveillance storage. However, an urgent need for TIARA loaded grenades was met by issuing these samples. The test involved a burst in specified fixed locations, so the C12 detonators were removed, and electrical fuzes used for bursting charges. Unfortunately, the C12 detonators were discarded without testing.

However, examination of the grenade bodies after removal of the detonators gave no evidence whatever of leakage of the TIARA load.

A lot of 100 was placed in surveillance storage with the intent of testing 10 grenades every six months for a total period of five years. On 5 December 1962 the first surveillance group was tested, of which four were duds. Twenty-six empty grenades with the C12 detonator were then tested, of which only one malfunctioned.

Since both the grenade bodies and the detonators had presumably passed an inspection before being accepted by Army Ordnance, the suspicion arose that TIARA fumes might possibly have affected the detonators. A program was immediately undertaken to determine and verify the specific cause of nonfunction. As a first step the local receiving inspection was reviewed.

RECEIVING INSPECTION

Grenade Bodies

The grenade body M25A2 consists of two hemispheres cemented together. A central channel is provided to receive the detonator, and an opening for filling. This is closed by a screw plug. Specification requires that the bodies show no leakage when tested under five pounds of air pressure.

Of the 1000 bodies received at the Naval Ordnance Test Station, 100 were tested under 30 pounds of air pressure. Since the 10% sampling showed no signs whatever of leakage, the other grenade bodies were not tested for leaks.

Detonators

No specification for testing the C12 detonator was available at the time of loading. However, 100 of the detonators were test fired in empty grenade bodies in lieu of a test fixture. The test was a simple go/no go function test in which delay time was approximately measured with the second hand of a wrist watch. Two duds were found.

In view of the high percentage of sampling, and mindful of issuance by Army Ordnance--and hence implied satisfactory quality--it was decided to use the detonators.

This Station was of the opinion that both grenade bodies and detonators were in keeping with specification.

SURVEILLANCE GRENADES

The four grenades which had failed in the surveillance test were carefully examined. The dud detonators were removed and the fuze cavities inspected. Neither by odor nor by luminescence could any trace of the TIARA load be found in the detonator compartment. This finding is in accord with the findings on 20 grenades returned from Vietnam.

Other detonators from the same lot were now assembled in the four duds, all of which then fired successfully.

The four defective detonators were sectioned at the vent. In three the primer had fired, while in the fourth the primer had not fired at all. Figure 1 shows the appearance of the fuze train of detonators in which the primer fired, and also of an unfired primer. Radiographs of a misfired, fired, and unfired primer are shown in Fig. 2.

These tests seemed to confirm adverse action of TIARA fumes upon the detonators, even in the absence of any evidence of exposure.

EFFECT OF TIARA FUMES ON C12 DETONATORS

Accordingly, a test was devised to determine specifically if TIARA vapors could in fact affect the C12 fuze train. Twenty-seven C12 detonators were stored in a TIARA formula 5 atmosphere in a desiccator with these results:

<u>Date</u>	<u>Number Fired</u>	<u>Number Duds</u>	<u>Days Exposure</u>
2/7/63	4	3	1
2/8/63	4	1	2
2/11/63	4	4	5
2/12/63	4	4	6

The test firing was discontinued and the remaining detonators stored in the open at room temperature to determine ability to recover. These detonators were fired as shown below:

<u>Date</u>	<u>Number Fired</u>	<u>Number Duds</u>	<u>Days of Recovery</u>
2/19/63	4	4	6
2/21/63	4	4	8
2/27/63	3	3	14

It is evident that gross exposure to TIARA fumes irreversibly affects the detonators.

As a further test 23 detonators were placed in the TIARA vapor desiccator after the vent holes had been wrapped with aluminum foil tape. When tested the following results were obtained:

<u>Date</u>	<u>Number Fired</u>	<u>Number Duds</u>	<u>Days Exposure</u>
2/14/63	4	0	1
2/15/63	4	1	2
2/18/63	4	1	5
2/19/63	4	2	6
2/21/63	4	2	8
2/27/63	3	2	14

It is evident that covering the vent holes delays the onset of damage by TIARA formula 5 fumes.

No experiments were run to determine whether the detonators could be completely sealed against TIARA fumes.

REPORT FROM PINE BLUFF ARSENAL

The incidence of duds was reported by telephone to Pine Bluff Arsenal, Arkansas, the source of the lot OM-1-23 detonators and to Edgewood Arsenal, Maryland.

On 14 February 1963 the Pine Bluff Arsenal reported in response to telephone request that detonator C12, lot OM-1-23, had been found defective, the malfunction being caused by the M39A1 primer used.

The Pine Bluff Arsenal also advised that a new procurement was in process for some 250,000 detonators C12. However, these would be fabricated with a Western Cartridge Company primer, EX 2926A, instead of the M39A1 design. The EX 2926A has a satisfactory service record. This contract was let in June 1963 to Olin Mathieson Company.

Inquiry was made to Edgewood Arsenal to ascertain if any detonators were available from the lot checked as the basis for contract award. The contract was let on the basis of past performance and no detonators containing the EX 2926A primer were available.

DETONATORS USING THE M5 PRIMER

In response to urgent request from NOTS for delivery of detonators from Olin Mathieson's first production (msg 202146Z June 63), Pine Bluff Arsenal shipped to this Station (9 July 63) 311 detonators, lot OM 4141-23-1052, from older stocks on hand and from unloaded grenades. Pine Bluff advised that these detonators contained the M5 primer which should have a longer shelf life than the M39A1 primer.

Twenty-six of these detonators were tested in empty grenade bodies and all fired satisfactorily. Shelf life data has not been available since these detonators are only about six months old.

On 3 July 1963 200 grenades, EX 1 Mod O, were loaded with these detonators. One hundred fifty-five were shipped to Fort Hood, Texas, 25 were shipped to MacDill Air Force Base, Florida, and 20 were shipped to Fort George Meade, Maryland. On 14 August 1963 an additional 62 were subsequently loaded and shipped to Fort Benning, Georgia. All of these grenades were assembled using detonators containing the M5 primer.

Of the 62 grenades shipped to Fort Benning, eight suffered from mechanical difficulties in pulling the firing pin. Of the 54 actually armed to fire, 53 functioned satisfactorily. The primer, M5, thus seemed to function well. This test was conducted on 9 September 1963.

Data on the other grenades is not yet available.

OTHER EXPERIENCE WITH C12 DETONATORS

Recently further malfunction has been reported for grenades assembled with the detonator C12.

The Second Marine Air Wing, Cherry Point, North Carolina, and the Force Troops, Fleet Marine Force, Twentynine Palms, California, both reported malfunction with the Grenade, Hand, Riot, CS1, M25A2 (Refs. 2, 3, 4). In both instances the grenades had been assembled with the defective C12 detonators.

On 17 July 1963 the Ordnance Supply Office, Mechanicsburg, Pennsylvania, suspended certain lots of these grenades from issue and use. (Ref. 5)

SUMMARY

The Grenade, M25A2, containing the CS1 load and the TIARA 5 load has exhibited malfunction.

Army Ordnance has advised that detonators, C12, lot OM-1-23 were defective due to the primer M39A1.

Grenades, Illuminating, EX 1 Mod O have been assembled with the C12 detonator using the M5 primer. No long storage data are as yet available.

Detonators fabricated with the Western Cartridge Company Primer EX 2926A have been ordered. Grenades will be assembled as soon as detonators are received.

No evidence whatever of leakage of the TIARA load has been found in any grenades examined.

Test data show that gross exposure to TIARA 5 vapors irreparably duds the C12 detonator using the M39A1 primer.

CONCLUSIONS

With the knowledge of a lot of defective detonators, there is the strong probability that the failure of surveillance samples of the Grenade, Hand, Illuminating EX 1 Mod 0 and malfunctions of those shipped to Vietnam from the same lot, may be ascribed to this cause.

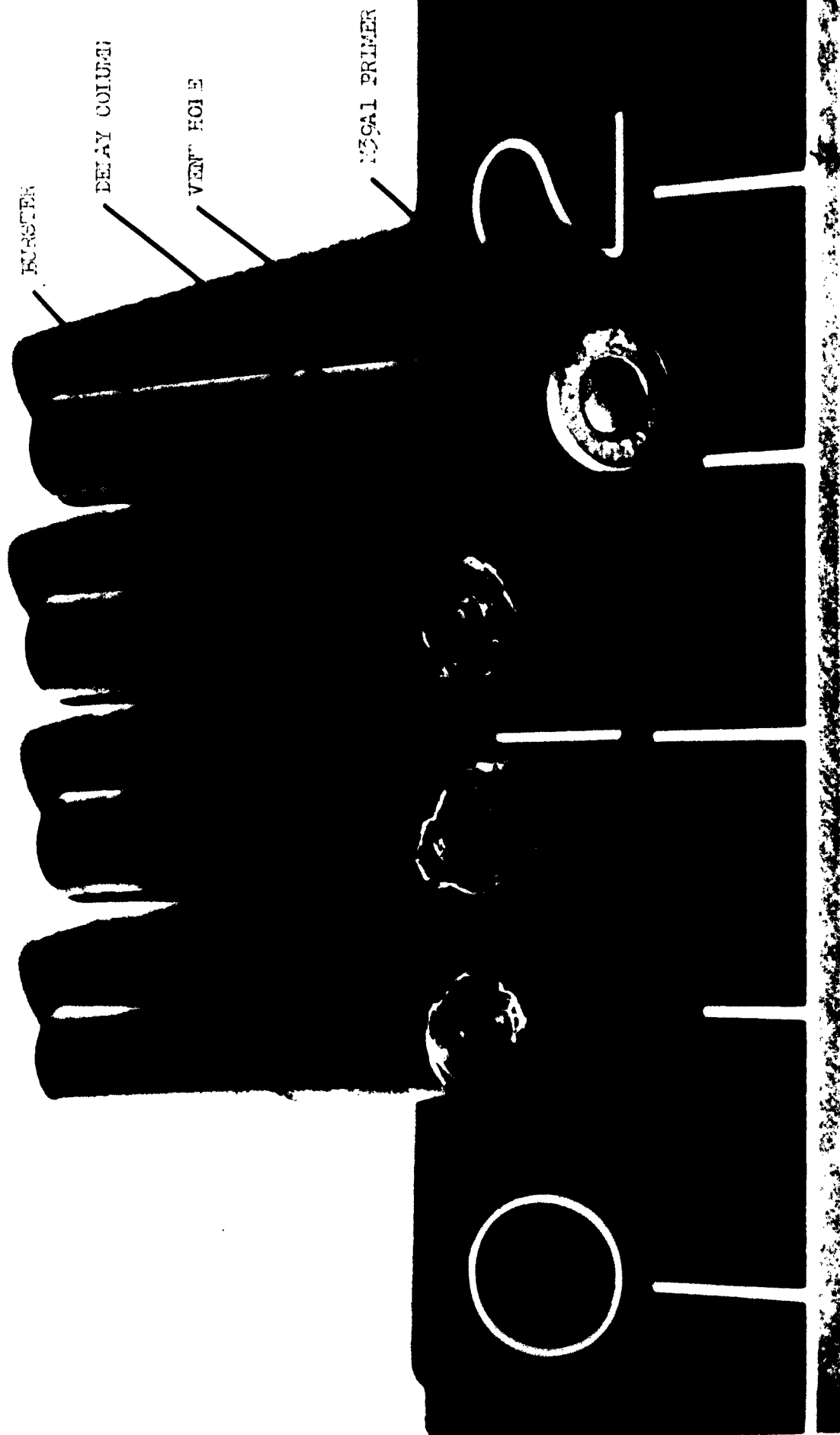


FIGURE 1. C-12 DETONATOR

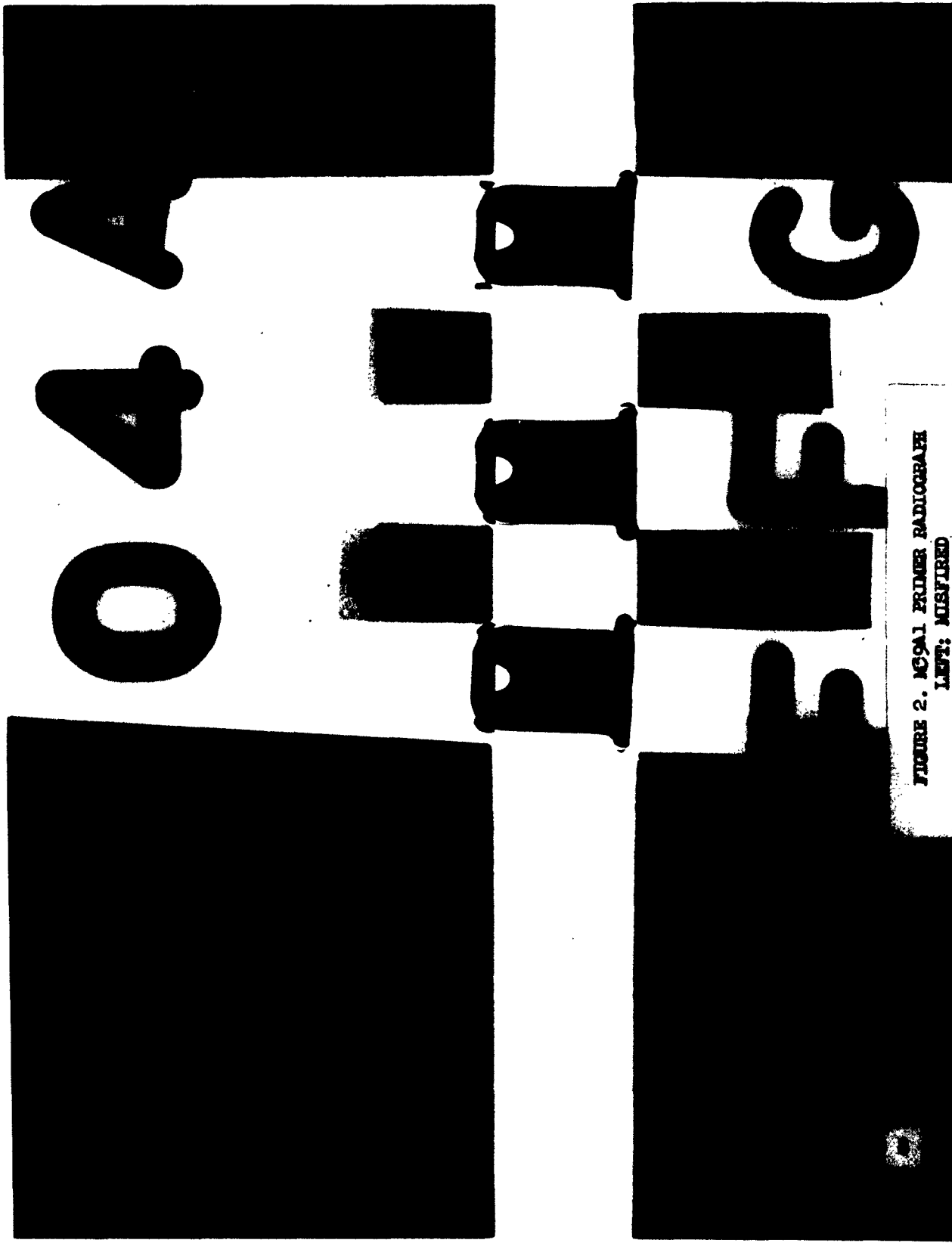


FIGURE 2. M99A1 PRIMER RADIOGRAPH
LEFT: MISFIRED

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3. Message 150420Z June 1963--From C. G. FORCETROOPS, Fleet Marine Force, Pacific, Twentynine Palms, Calif. to OSO, Mechanicsburg, Penna.
4. Ltr. 8/sjl, 8000, 8 July 1963--From C.G. FORCETROOPS, Fleet Marine Force, Pacific, Twentynine Palms, Calif. to OSO, Mechanicsburg, Penna.
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